

# Petr Stepanov

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## Work Experience

### C++ Software Developer • Research Collaborator (On-Site)

[Thomas Jefferson National Laboratory \(JLab\)](#), Newport News, VA.

Jul 2020 - Jan 2023

- Coded a Geant4-based simulation for studying the optimal light guide length (range 0-10 cm) for the [EM calorimeter](#) used in the Electron-Ion-Collider (EIC) project. [Link to GitHub](#).
- Used Machine Learning (ML) techniques to perform binary classification of thousands of signals from a data acquisition (DAQ) setup. [Link to GitHub](#).
- Applied CERN ROOT framework (C++) to perform statistical analysis of a significant amount (over 100 GB) of the raw experimental data of the [Kaon LT](#) experiment at JLab. [Link to GitHub](#).
- Utilized SLURM functionality on the High-Performance Computing (HPC) environment to execute a series of simulations in parallel. This reduced the wall time by more than 10 times.
- Set up data acquisition system that performs triggered waveform acquisition involving 3 devices - Tektronix oscilloscope, Network Attached Storage, and RedHat computer (SAMBA, Python, National Instruments NI-VISA library).
- Contributed 100+ shifts at Hall C at the Thomas Jefferson Particle Accelerator facility for the [Pion LT project](#).

### Postdoctoral Researcher • Software Developer (Remote)

[Catholic University of America \(CUA\)](#), Washington, DC.

Jul 2020 - Jan 2023

- Programmed a Geant-4 computer simulation (C++, CMake, Eclipse IDE, gdb) to study the performance of a novel scintillation material for EIC, Brookhaven National Lab. [Link to GitHub](#).
- Visualized energy deposition profiles and calculated energy resolutions for a variety of detector assemblies.
- Teaching experience. Mentoring students within a 3-month Research Experiences for Undergraduates (REU) program at the Physics Department at CUA.
- Enhanced debugging of the CERN library source code led to the publishing of more than [10 bug reports](#) on the ROOT (C++) forum.

### Software Developer • Research Assistant

[Bowling Green State University \(BGSU\)](#), Bowling Green, OH.

Aug 2014 - May 2020

- Assembled positron lifetime and Doppler spectrometers from ORTEC and Canberra (Mirion) fast electronic units. Utilized High-Purity Germanium Detectors (HPGe) and scintillation-based detector systems for single-photon counting.
- Developed three open-source programs (C++, CERN ROOT) for a novel interpretation of the positron lifetime and Doppler experimental spectra.
  - Derived and solved kinetic equations describing the formation and chemical reactions of e<sup>+</sup> and Ps atoms in solids, liquids, and nano-powders (Wolfram Mathematica).
  - Incorporated physical parameters (grain size, defect concentrations, rate constants) into custom models (PDFs with convolution) for fitting the experimental spectra (RooFit).
- The above research allowed for the estimation of defect concentrations and sizes in solids, classification of defect types (vacancies, dislocations), and characterization of the chemical decoration of defects.
- Wrote three desktop GUI programs for spectra fitting and interpretation (C++, CMake, ROOT, Qt, Java)
  - GitHub repositories contain over 10k lines of code in total: [TLIST Processor](#), [SW Calculator](#), [RooPositron](#).
  - Extended default ROOT GUI library (Qt-based) to support the MVP design pattern.
- Wrote a GUI application [LuminApp](#) (Java, Swing) to parse and merge time-stamped data from optical spectrometer and thermometer. This increased data processing time by two orders of magnitude.
- Developed static website (Hexo, Gulp, Bootstrap) and visual identity for the [SelimLab](#) research group. The website has a 99% Google performance rank and features 700 ms time to interactive metrics.
- Maintained local Apache HTTP server [physics.bgsu.edu](http://physics.bgsu.edu) hosting over 10 websites at the BGSU.
- Created website for the [ICPA-18](#) international conference with registration (over 150 users) and payment system workflow (WordPress, PHP, Recurly.js), and [landing pages](#) for events.

### Frontend Developer, UI/UX Designer • Freelance

Sep 2012 - May 2020

- Designed and built an online e-commerce store [Sticker Store LLC](#) with a static website generator (Figma, Hexo, Snipcart, Bootstrap, SASS, Express.JS, EJS, Node.js).
  - Improved the Google PageSpeed Insights metrics (CLS, LCP) up to 97%.
  - Created a recursive script to export over 300 products from YAML file to Google Merchant.
  - Optimized SEO. The project reached over 1400 organic monthly users.
- Made iOS application (Swift, UIKit, storyboards) for the [We.Team](#) messenger (more than 3k monthly downloads in AppStore). Participated in cloud-based messenger development with enhanced file sharing capabilities (HTML, React JS, SASS).
- Migrated the landing page for [Sweetbridge](#) company from WordPress to Jekyll static site generator (Ruby, CSS). This resulted in a 70% improvement in the page load time.
- Developed the front-end part (Angular.js, HTML, LESS) for [Lili Social](#) network.
  - Assisted with iOS mobile application (Ionic).
  - Enabled SEO crawling of over 1000 Angular.js pages with Google bot.
- Web design.
  - Designed logos, UI/UX prototypes (Figma, Sketch, Illustrator) and branding identity for over [10 different companies](#).
  - Converted numerous design assets and mockups into responsive HTML and CSS.
  - Mocked up and integrated dozens of cross-browser responsive email templates.

### Full Stack Web Developer, Web Designer

[Gridnine Systems](#), Moscow, Russia.

*Apr 2011 - Aug 2014*

- Prototyped and designed interactive mockups for [Otixo](#) cloud file integrator (Balsamiq, Adobe Creative Suite). Utilized Google Web Toolkit (GWT) Model-View-Presenter (MVP) framework to develop application frontend (JavaScript, responsive CSS).
- Responsible for the front-end development of the [ATH American Express](#) – the largest travel management company in Russia (JavaScript, Backbone.js, and RequireJS). Increased the front-end load time by over 30%.
- Implemented image processing servlets on the backend to generate banners for five different social networks (PHP, ImageMagic).
- Wireframed and sliced to web pages numerous UI/UX mockups for web applications (Balsamiq, Photoshop, HTML and CSS).

### Computer Science Teacher

[Phys-Tech College at MIPT](#), Moscow, Russia.

*Oct 2009 - May 2011*

- Provided instructions and guidance to high school students on the following computer courses: C/C++ programming, HTML, Adobe Photoshop and 3D Studio Max.

### Research Scientist

[Institute for Theoretical and Experimental Physics \(ITEP\)](#), Moscow, Russia.

*Sep 2008 - Apr 2011*

- Application of positron lifetime spectroscopy for studying the radioactive-induced defects in steels. Monte-Carlo particle simulations with Fortran 95. Maintaining software for CAMECA tomographic atom probe (MSVC). Application of CERN ROOT libraries for fitting and analysis of experimental spectra.

## Material Research Skills

- **Characterization facilities.** Positron Lifetime and Doppler Broadening Annihilation Spectroscopy (PALS, DBAR). Atom Probe Tomography (ATP). Scanning Electron Microscopy (SEM). Transmission electron microscopy (TEM). Atomic Force Microscopy (AFM). UV-VIS Spectroscopy. Fourier Transform Infrared Spectroscopy (FTIR).
- **Material processing.** High-temperature annealing. Wet chemical etching. Electrical Contact Fabrication. Sample polishing.

## Education

**Bowling Green State University (BGSU) • OH, United States**

*Aug 2014 - May 2020*

Ph.D. in Photochemical Sciences • GPA 3.423. [Dissertation](#): Novel developments in positron spectroscopy (PAS).

- Assembled and utilized two spectrometers: positron lifetime and Doppler. Spectrometers are built from ORTEC and Canberra (Mirion) fast electronic units and utilize High-Purity Germanium Detectors (HPGe) and scintillation-based

detector systems.

- Developed open-source software (C++, CERN ROOT) for a novel interpretation of the experimental spectra.
- Defined and resolved kinetic equations of reactions of positron and positronium atoms (Ps) in solids and liquids and nano-powders (Wolfram Mathematica). Equation parameters are implemented in the fitting model of experimental spectra (RooFit).
- Above research allowed for the estimation of defect concentrations and sizes in solids, classification of defect types (vacancies, dislocations), and more...

#### **Ohio Supercomputer Workshop • OH, USA**

Jan 2017 - Feb 2017

Hands-on sessions in High-Performance Computing Infrastructure (HPC, SSH, BASH, SLURM).

#### **British Higher School of Art and Design (BHSAD) • Moscow, Russia**

Dec 2011 - Feb 2012

Three-month intensive in Graphical Design and Visual Communications (illustration, lettering, brand identity).

#### **National Research Nuclear University (MEPhI) • Moscow, Russia**

Sep 2004 - Feb 2011

B.S. and M.S. in Solid State Physics. Thesis: application of PAS for defect concentration studies in bulk materials.

## **Featured Publications**

- P. S. Stepanov, F. A. Selim et al. Interaction of positronium with dissolved oxygen in liquids. *Physical Chemistry Chemical Physics* **2020**, 22 (9), 5123-5131. [10.1039/c9cp06105c](https://doi.org/10.1039/c9cp06105c).
- P. S. Stepanov, F. A. Selim et al. A model for joint processing of LT and CDB spectra of dielectric nano-sized powders. *AIP Conference Proceedings* 2182 **2019**. [10.1063/1.5135836](https://doi.org/10.1063/1.5135836).
- P.S. Stepanov, S.V. Stepanov et al. Developing New Routine for Processing Two-Dimensional Coincidence Doppler Energy Spectra and Evaluation of Electron Subsystem Properties in Metals. *Acta Physica Polonica A* **2017**, 132 (5), 1628-1633. [10.12693/aphyspola.132.1628](https://doi.org/10.12693/aphyspola.132.1628).

## **Conferences**

#### **18th International Conference on Positron Annihilation (ICPA-18)**

Aug 2018

Orlando, FL, USA

Oral talk "Positions and Ps in Al<sub>2</sub>O<sub>3</sub> Nanopowders"

#### **International Workshop on Physics with Positrons (JPos17)**

Sept 2017

JLab, Newport News, VA, USA

Poster "A routine of background subtraction from two-dimensional Doppler broadened spectra"

#### **12th International Workshop on Positron and Positronium Chemistry (PPC12)**

Sept 2017

Maria Curie-Sklodowska University, Lublin, Poland

Poster "Developing new routine for processing two-dimensional coincidence Doppler energy spectra"

#### **Ohio Photochemical Society Meeting (Oops)**

May 2017

Maumee Bay Lodge & Conference Center, Maumee, OH, USA

Poster "Developing new routine for background subtraction in two-dimensional coincidence Doppler broadening spectroscopy"

#### **58th Electronic Materials Conference (EMC)**

Jun 2016

University of Delaware, Newark, DE, USA

Oral talk "High-Sensitivity Measurements of Defects in ZnO by Means of Digital Coincidence Doppler Broadening of Positron Annihilation Spectroscopy"

#### **Annual Spring Meeting of the APS Ohio-Region**

Apr 2016

University of Dayton, Dayton, OH, USA

Oral talk "Identification of chemical environment of defects in ZnO by means of digital coincidence Doppler broadening of positron annihilation radiation"

#### **Ohio Inorganic Weekend**

Nov 2015

Bowling Green State University, OH, USA

Poster "Approaching Structural Defect Characterization and their Chemical Identification by Means of Coincidence Doppler Broadening of Annihilation Radiation"

**41st Polish Seminar on Positron Annihilation (PSPA-13)**

*Sep 2013*

Maria Curie-Skłodowska University, Lublin, Poland

Oral talk "Application of positron spectroscopy for detection of nanostructures in alcohol—aqueous mixtures"

## Professional Networks

- Find examples of my code [on GitHub](#) (50+ repositories).
- Discover my professional contacts [on LinkedIn](#) (200+ connections).
- Skim through the list of my publications [on Google Scholar](#) (24 articles, 300+ citations).
- Check out my UI and UX design portfolio [on Dribbble](#) (50+ shots).

## Relevant Interests

- Hosting an open-source project for keyboard remapping on Linux [300+ stars on GitHub](#).
- Developed a [RAMDisk plugin](#) for Linux that provides 50% increase in source code indexing time.
- Created two shared libraries for the ROOT data analysis framework [\[1, 2\]](#).
- [Right to repair](#) follower. Collecting and repairing old phones and laptops.
- Volunteer mechanic and fabricator at a non-profit automotive shop in Oregon City, OR.